BELLCOMM, INC.
1100 Seventeenth Street, N.W. Washington, D.C. 20036

SUBJECT: Evaluation of the Report by Neotec Corporation on "Study of Erectile Antenna Types" Case 730

DATE: February 29, 1968

FROM: C. C. Ong

ABSTRACT

The Neotec Corporation has conducted a study on Erectile Antenna types under contract to JPL. This memorandum summarizes the report and evaluates the results as applied to a manned mission.

Despite Neotec's conclusion that the Swirlabola is best, it is the author's opinion that individual petals offer more advantages for a manned mission. The reason for this is the difference in selection criterion between manned and unmanned missions.

Neotec's approach is based on personal opinion and judgement, even though the final results is a numerical rating. Differences in final ratings may not be significant. A simple listing of antenna types, in order of preference, would be just as meaningful.

(NASA-CR-94009) EVALUATION OF THE REPORT BY NEOTEC CORPORATION ON STUDY OF ERECTILE ANTENNA TYPES (Bellcomm, Inc.) 14 p

N79-72633

Unclas
00/32 11139

BELLCOMM, INC.
1100 Seventeenth Street, N.W. Washington, D.C. 20036

SUBJECT: Evaluation of the Report by Neotec Corporation on "Study of Erectile Antenna Types" Case 730

DATE: February 29, 1968

FROM: C. C. Ong

MEMORANDUM FOR FILE

JPL has contracted with the Neotec Corporation of Rockville, Maryland (Contract No. 951847) to conduct a study of erectile antenna types, which are applicable in near-earth or interplanetary missions.

The objectives of the study are (1) to evaluate parametrically six antenna concepts and to establish the optimum weights for each concept, (2) to perform analytical studies on a more consistent basis in order to permit a meaningful comparison of the six candidate concepts, and to provide a relative rating of such techniques, and (3) to isolate and recommend areas where further studies would yield maximum benefit in advancing the field of space-erectile antennas.

The six antenna types studied are radial ribs, hybrid, individual petal, interconnected petal, parabolic scissors and swirlabola (See Figures 1 to 7). The results of the study consist of the following:

1. The lightest antenna configuration can be determined from the data presented. The analysis covers a range of antenna deployed diameter varying from 9 to 16 feet and a range of antenna stowed diameter varying from 54 to 114 inches. Antenna weight estimates considered stowed configuration packaging ratio, thermal deflection limits, 1 g ground test deflection limits, stowed and deployed configuration structural natural frequency, ascent loading conditions, and an assumed 2 g mid-course maneuver load in the deployed configuration.

2. A relative rating of the six antenna types was presented as given by Table 1. In this table the degree of parabolic approximation (in the deployed configuration), weight, deployment relability, technical risk, degraded mode capability, and cost were quantified on a scale from 0 to 10.

Weighting factors as to degree of importance of these items were similarly assigned on a scale of 0 to 10. The higher the numerical rating, the higher the quality.

The antenna ratings were:

Antenna Technique	Net Weighted Score
1. Swirlabola	307
2. Individual Petal	276
3. Hybrid	270
4. Radial Ribs	257
5. Interconnected Petal	211
6. Parabolic Scissors	198

The highest rating for the Swirlabola antenna results largely from the unique possession of a degraded mode capability, plus a small antenna weight. For any of the other antenna technique considered in the study, failure of the ribs or trusses to successfully deploy would result in a useless antenna. This is due to the aperture blockage of the mesh in proximity to the feed mast in the stowed configuration. The Swirlabola technique, however, does have modest degraded mode capability. The Individual Petal technique occupies the second position because of the high expected degree of parabolic surface approximation, coupled with the low expected technical risk associated with the concept.

3. The Swirlabola technique was recommended for further development. This technique relies greatly upon the geometric accuracy of the preforming operation. Further developments of performing techniques could lead to a singificant advance in the state-of-the-art. The true physical characteristics of a reflecting mesh, suitable for use with the erecting techniques studied, were only poorly defined. The properties of the fiberglass mesh selected in the study are hardly an optimum either as to material or dimensions. Before doing any more antenna work, more testing is needed to get a good mesh material.

Neotec's report emphasized the deployment reliability and the degraded mode capability of the Swirlabola technique in selecting it as the most desirable antenna technique. While this conclusion seems to be justified for a unmanned mission, it may not be so for a manned mission. For, in the latter case, failure to deploy the antenna can presumably be repaired by the astronauts. Consequently Deployment Reliability and Degraded Mode Capability are of smaller importance in the evaluation of antenna techniques for manned missions. Deleting these two items from Table 1 the rating of the six antenna types then becomes:

	Antenna Techniques	Net Weighted Score
1.	Individual Petal	216
2.	Hybrid	210
3.	Interconnected Petal	191
4.	Radial Ribs	177
5.	Parabolic Scissors	149
6.	Swirlabola	145

It can be seen that the Swirlabola technique, which is the most desirable one in the original rating, becomes the least desirable one.

Both the ratings and the weighting factors are matters of judgement, and are completely dependent on the person doing the evaluating. A precise evaluation is clearly impossible. In addition, the final scores can be rearranged with small changes in weighting factors. This means that it is impossible to know how meaningful the final scores are, even in comparing one antenna to another. It is the author's opinion that the differences in final scores, for either of the two tables presented, may not be significant. In fact, simply adding up the item scores is a misleading approach. For example the high scoring antenna could have a zero for technical risk, indicating that it would be impossible to develop. Consequently, this approach to evaluating antennas has limited value. It seems that simply listing the antennas in order of preference would be just as meaningful, and would require much less bookkeeping.

It should also be pointed out that on a spacecraft designed for a planetary mission, it is desirable to have a directional antenna with a deployed diameter of at least 30 ft. Antennas of this size are not covered in the study conducted by Neotec Corporation. However, extrapolation can be made from their results for weight estimation of these large aperture antennas, presumably made of Beryllium with a pre-formed matallized, polysulfphide coated fiberglass reflecting mesh. For example, an Individual Petal antenna with a deployed diameter of 30 ft and a stowed diameter of 8.5 ft has an estimated weight and packaged volume of 160 lb and 720 ft^3, respectively; whereas for a Swirlabola antenna of the same deployed diameter and a stowed diameter of 13 ft, the weight is estimated to be 80 lb and the packaged volume to be 690 ft^3, with a mast protrusion of about 64 in forward of the stowed swirlabola ribs.

C. C. Ong

C. C. Ong

1013-CCO-nmm

Attachments
  Figures 1-7
  Table 1
  References

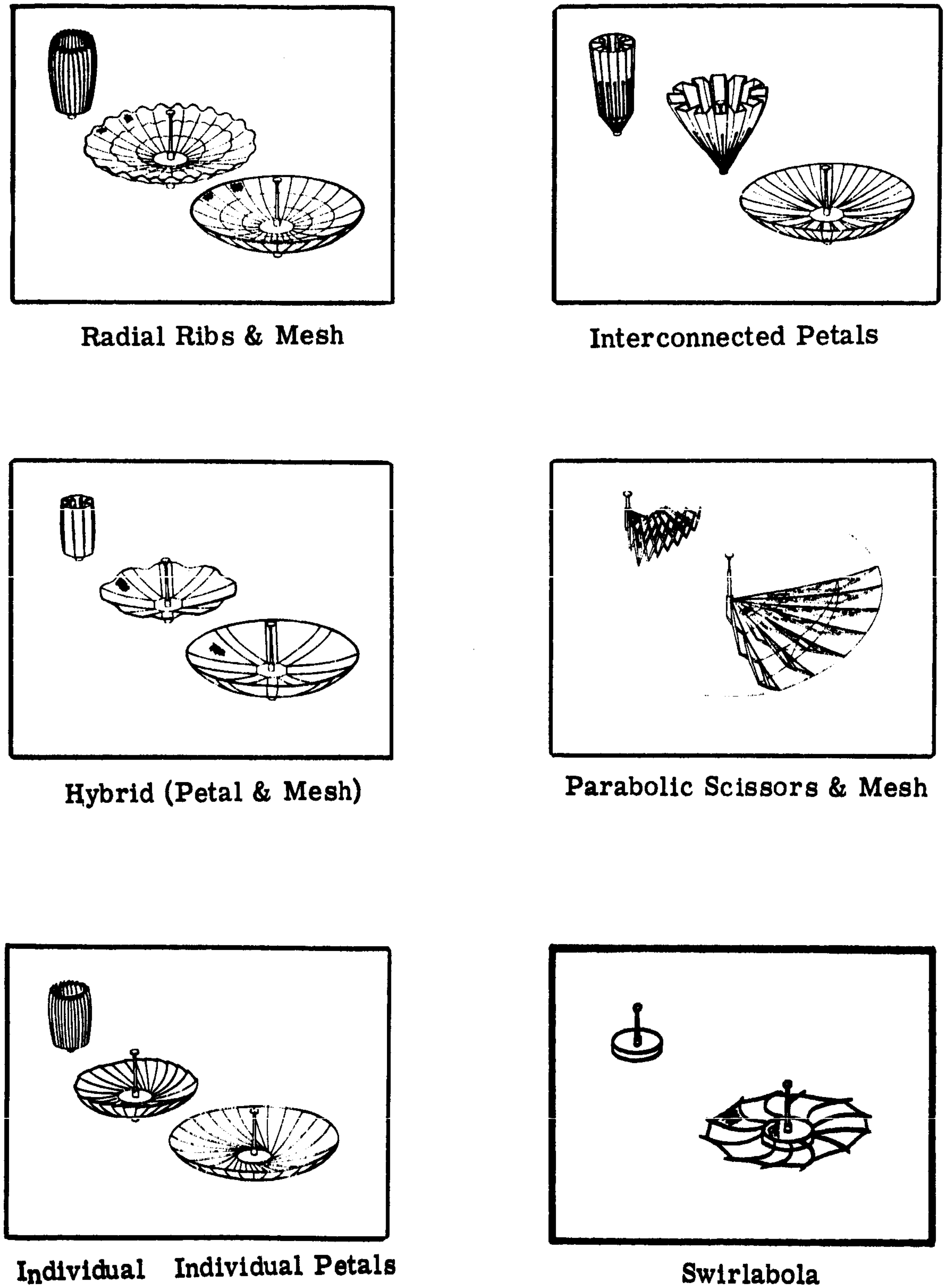

FIGURE I - ANTENNA ERECTING TECHNIQUES

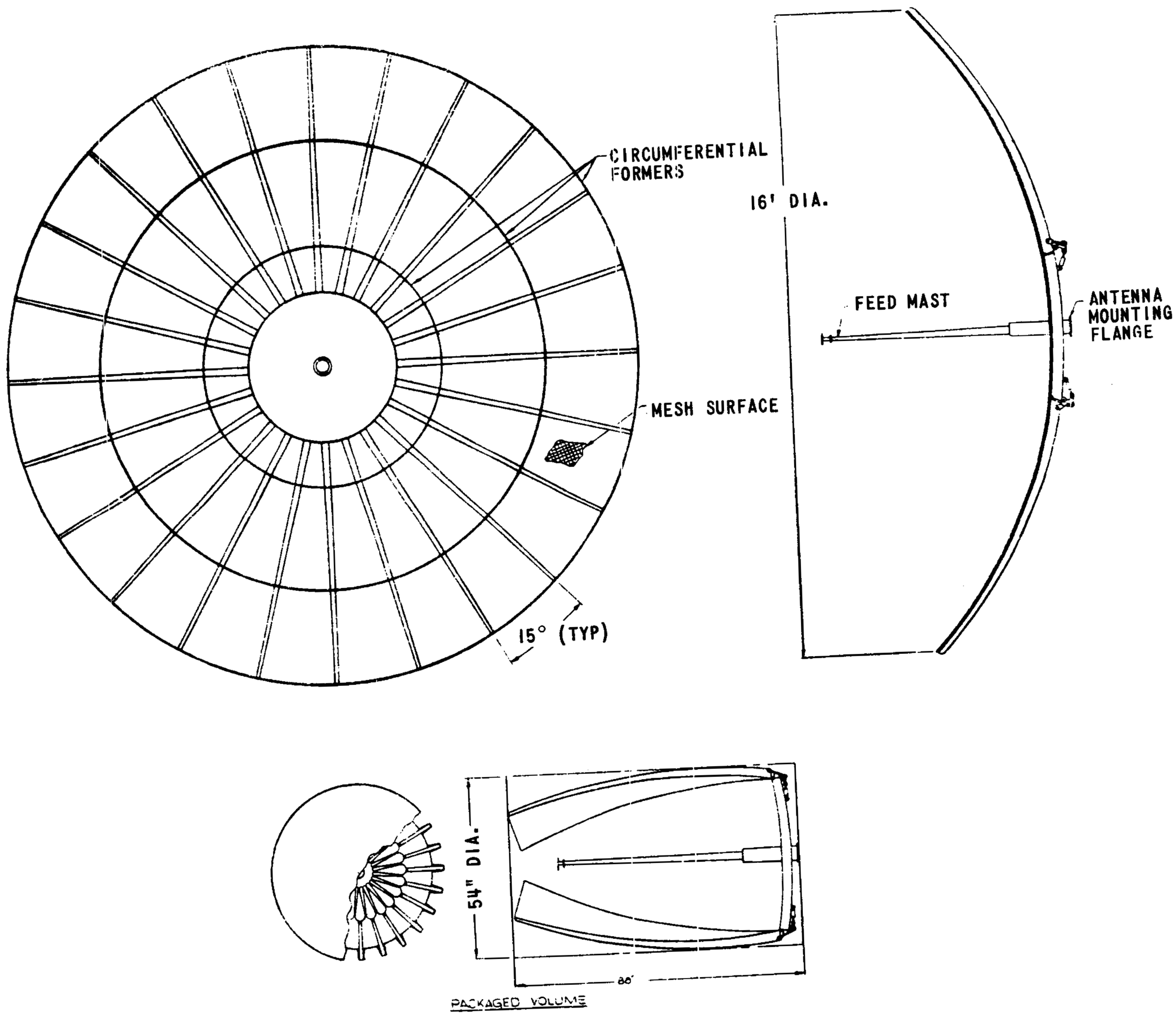

FIGURE 2 - RADIAL RIB TECHNIQUE

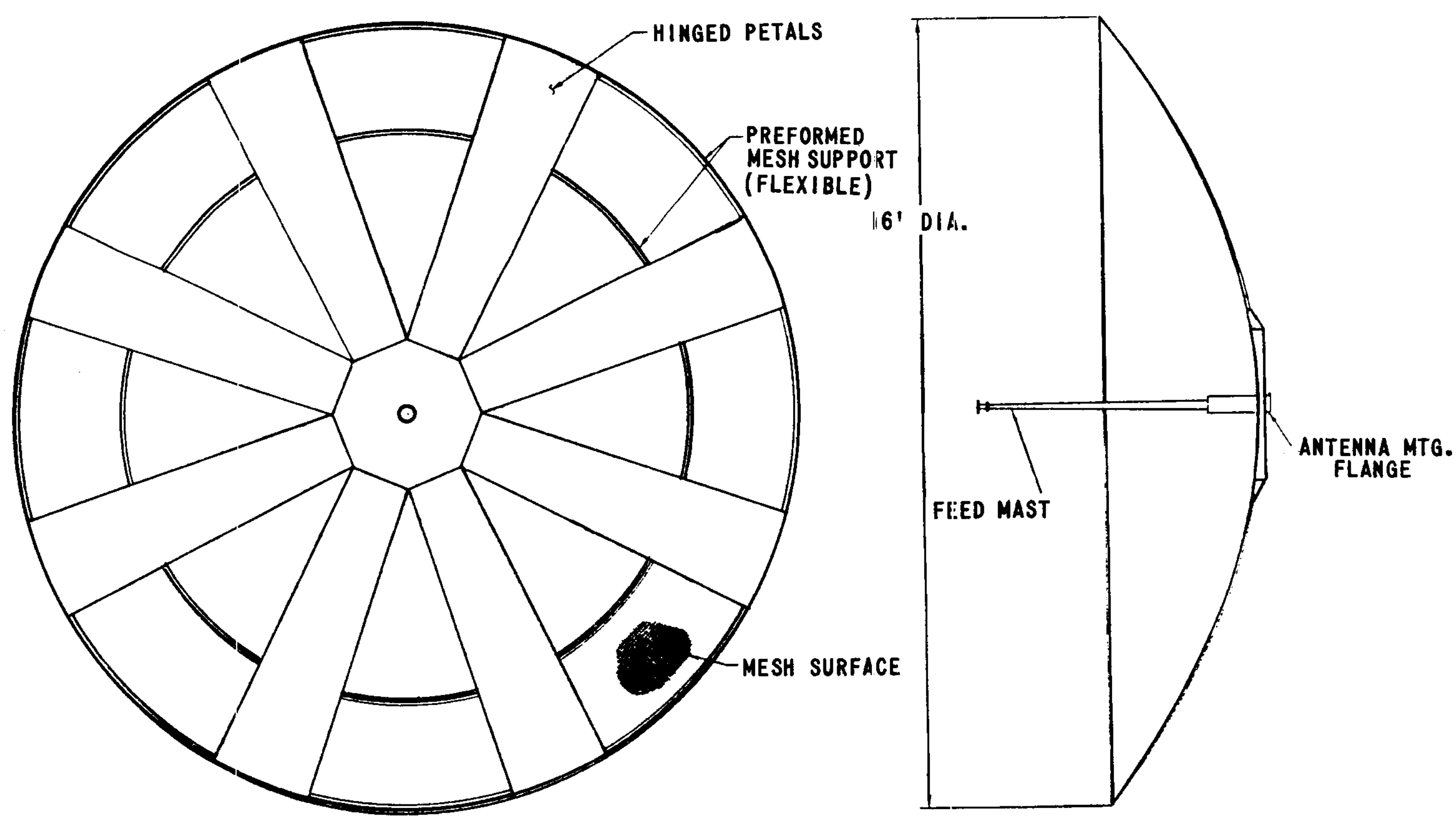

FIGURE 3 - HYBRID TECHNIQUE

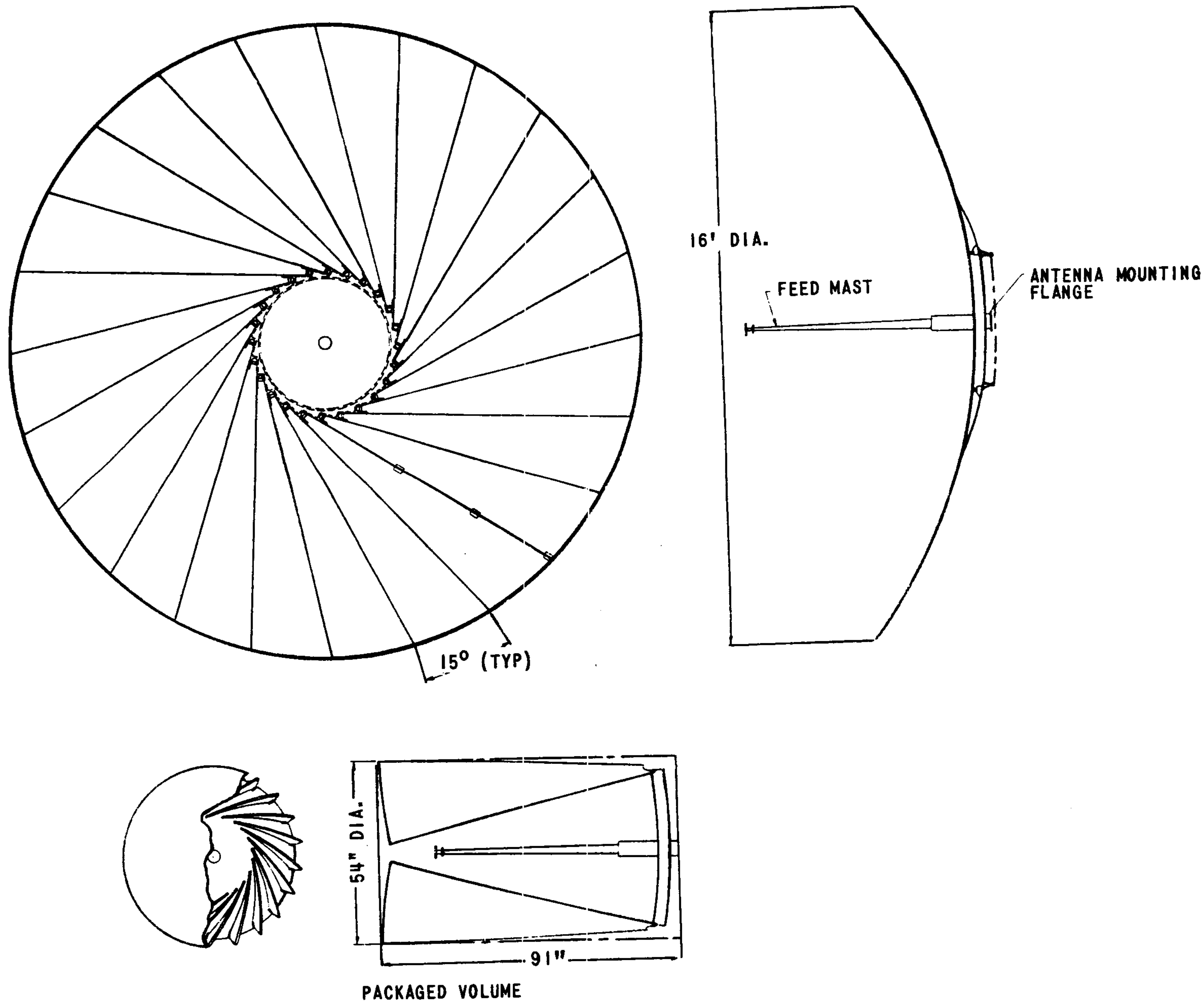

FIGURE 4 - INDIVIDUAL PETAL TECHNIQUE

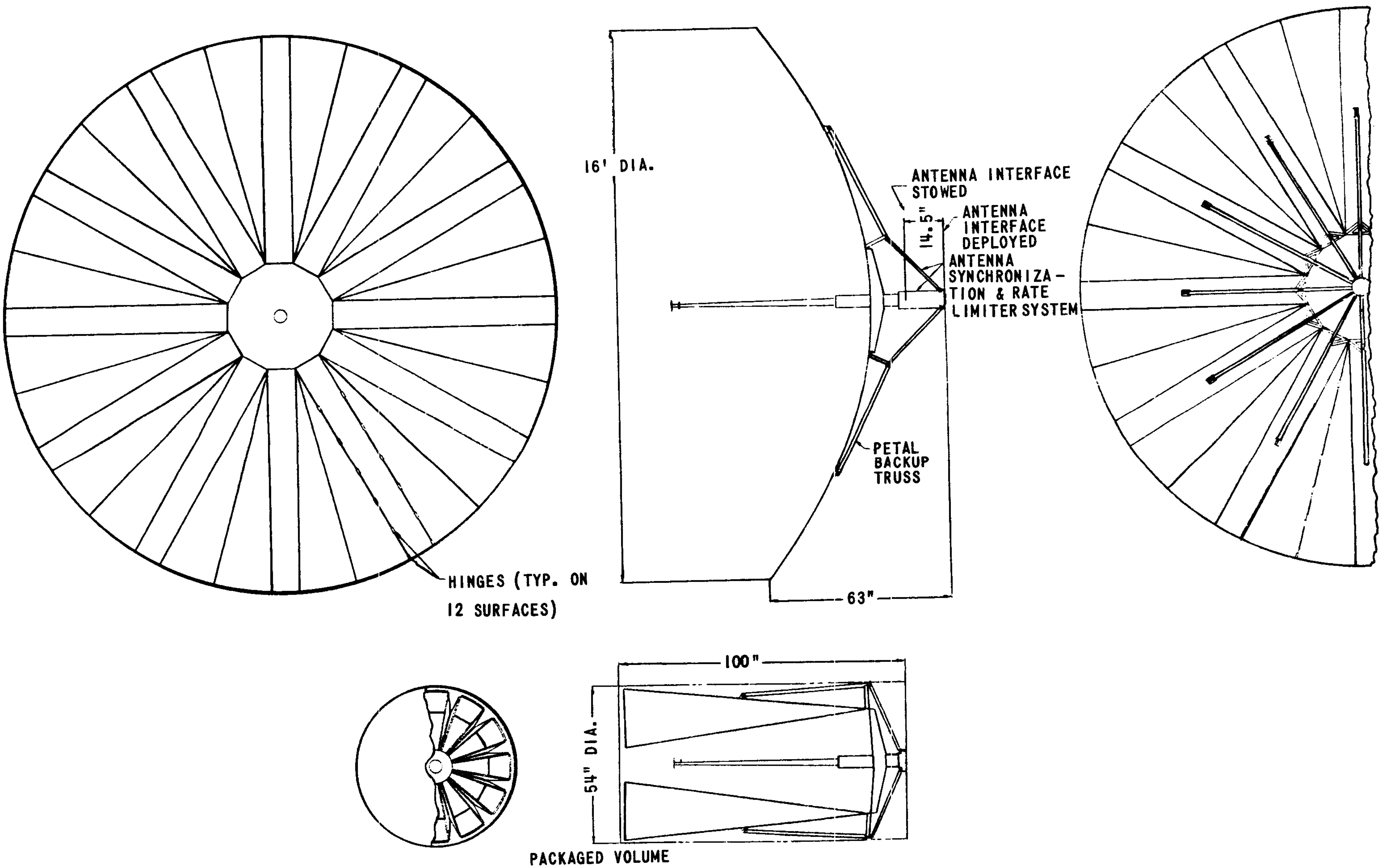

FIGURE 5 - INTERCONNECTED PETAL TECHNIQUE

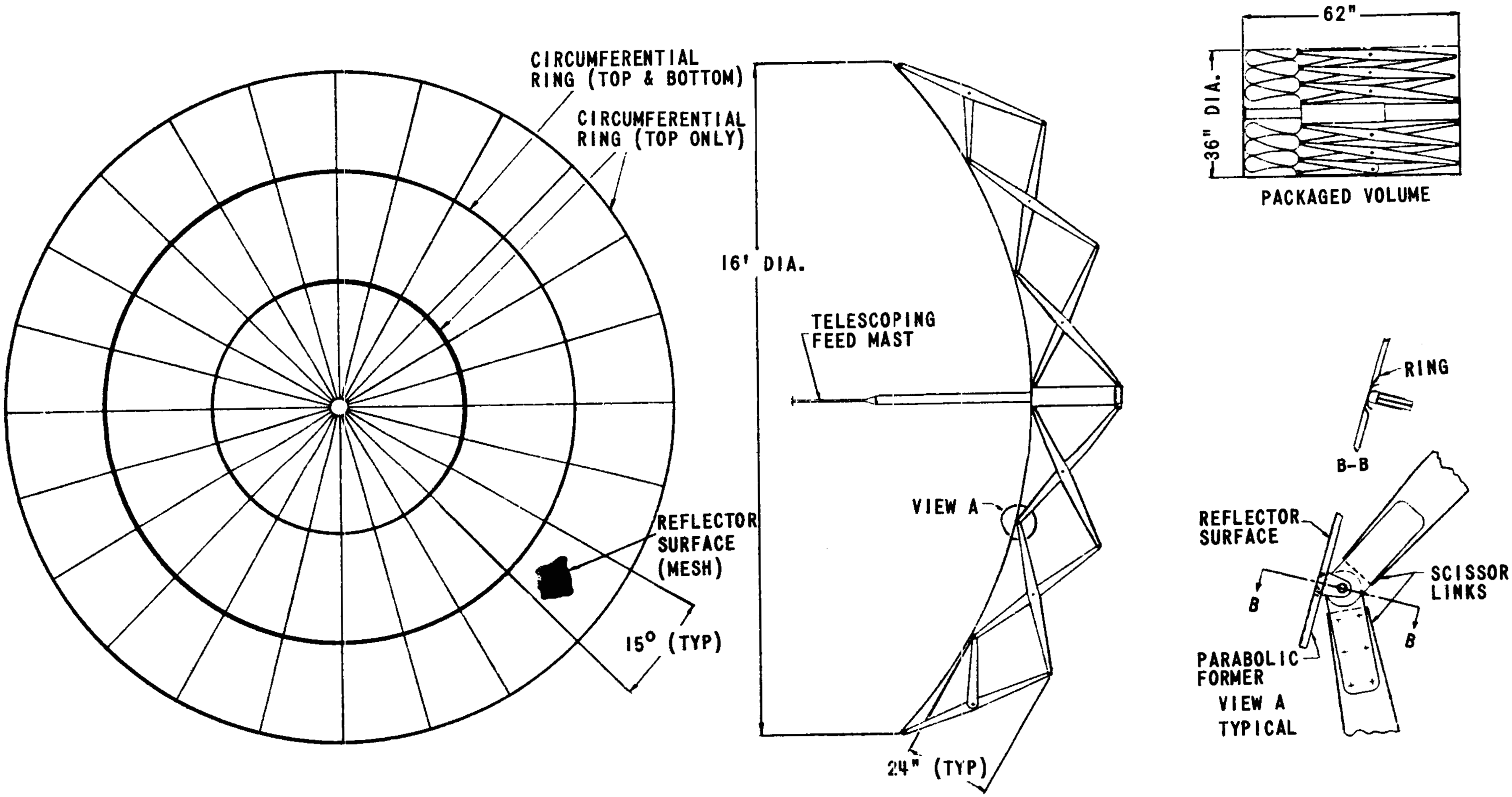

FIGURE 6 - PARABOLIC SCISSORS TECHNIQUE

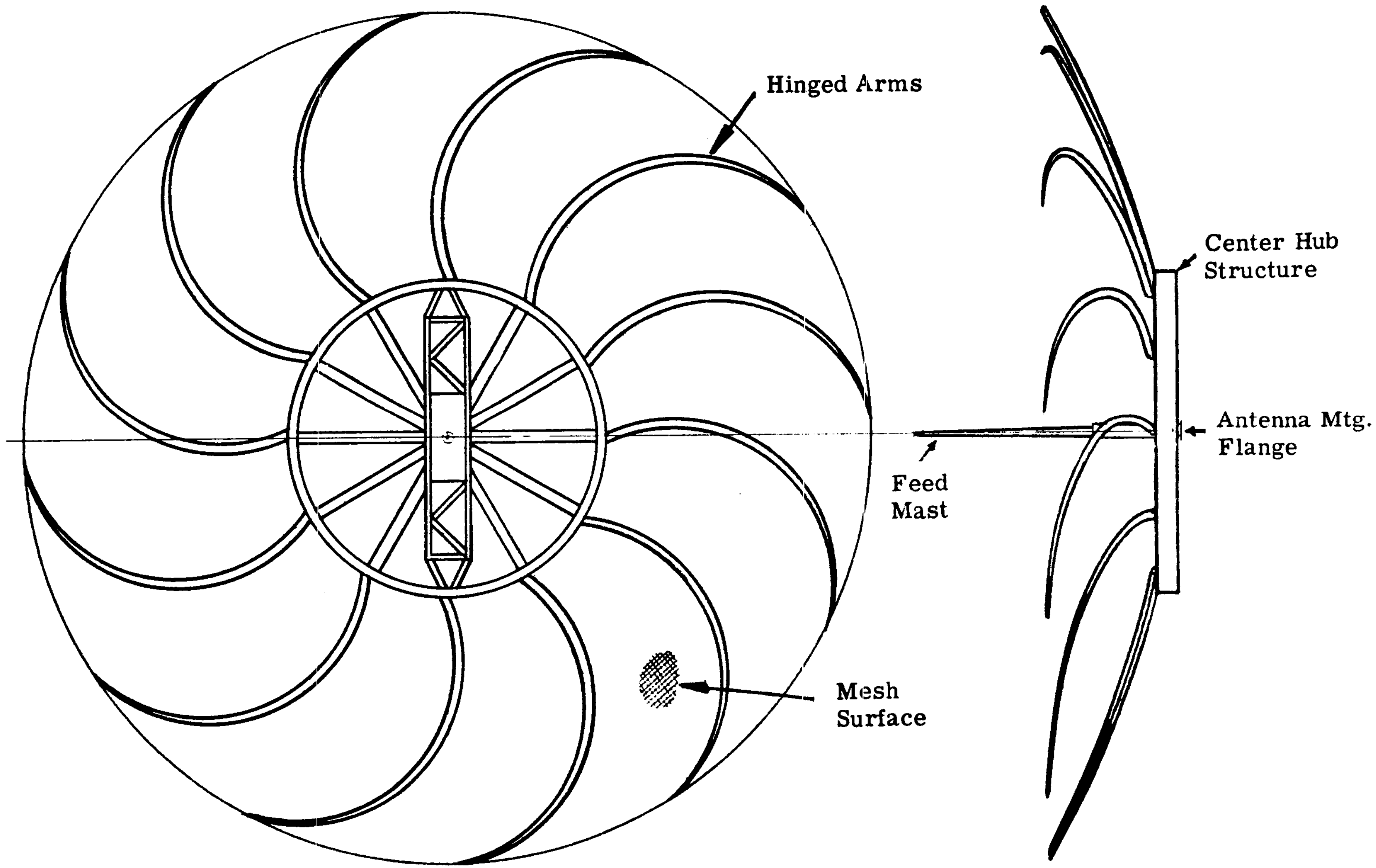

FIGURE 7 - SWIRLABOLA TECHNIQUE

TABLE I - RELATIVE ANTENNA RATING

Item		Antenna Technique											
		Radial Ribs		Hybrid		Individual Petal		Interconnected Petal		Parabolic Scissors		Swirlabola	
	A*	B*	C*	B*	C*	B*	C*	B*	C*	B*	C*	B*	C*
Degree of Parabolic Surface Approximation	8	3	24	6	48	9	72	8	64	3	24	3	24
Weight	7	9	63	7	49	4	28	3	21	7	49	8	56
Deployment Reliability	10	8	80	7	70	6	60	2	20	3	30	9	90
Technical Risk	9	5	45	7	63	9	81	9	81	5	45	5	45
Degraded Mode Capability	8	0	0	0	0	0	0	0	0	0	0	9	72
Cost	5	9	45	8	40	7	35	5	25	10	50	4	20
Net Weighted Score			257		270		276		211		198		307

*A = Item Weighting Factor
B = Item Rank
C = Item Score = A x B

REFERENCES

1. Radany, E. W., "Erectile Antenna Study," Neotec Corporation, Final Report, October 17, 1967.

2. Gerwin, H. L., "GSFC Phase A Analytical Report for ATS-F&G," GSFC, February, 1967.

BELLCOMM, INC.

Subject: Evaluation of the Report by Neotec Corporation on "Study of Erectile Antenna Types" - Case 730

From: C. C. Ong

Distribution List

NASA Headquarters

Copy to
Messrs. F. P. Dixon/MTY
P. Grosz/MTL
E. W. Hall/MTG
T. A. Keegan/MA-2
R. L. Lohman/MTY
D. R. Lord/MTD
A. D. Schnyer/MTV
J. W. Wild/MTE

MSC

Copy to
Mr. W. E. Stoney, Jr./ET

MSFC

Copy to
Mr. F. L. Williams/R-AS-DIR

Bellcomm

Copy to
Messrs. F. G. Allen
G. M. Anderson
A. P. Boysen
C. L. Davis
J. P. Downs
D. R. Hagner
P. L. Havenstein
N. W. Hinners
W. C. Hittinger
B. T. Howard
D. B. James

Bellcomm

Copy to
Messrs. J. Kracton
H. S. London
K. E. Martersteck
R. K. McFarland
J. Z. Menard
G. T. Orrok
I. M. Ross
F. N. Schmidt
J. M. Tschirgi
R. L. Wagner
J. E. Waldo
All Members, Div. 101
Division 103
Central File
Department 1023
Library